1. The velocity distribution for the flow of crude oil at 100°F \( (\mu = 8 \times 10^{-5} \text{lbf} \cdot \text{s} / \text{ft}^2) \) between two walls is given by \( u = 100y(0.1 - y) \text{ft/s} \), where \( y \) is measured in feet and space between the walls is 0.1 ft. Determine the shear stress at the walls and at the centerline.

![Figure 1 (for Problem 1)](image1)

![Figure 2 (for Problem 2)](image2)

2. The velocity of water flow in the nozzle shown is given by the following expression: \( V = 2t/(1 - 0.5x/L)^2 \), where \( V \) = velocity in feet per second, \( t \) = time in seconds, \( x \) = distance along the nozzle, and \( L \) = length of the nozzle = 4 ft. When \( x = 0.5L \) and \( t = 3s \), what is the local acceleration along the centerline? What is the convective acceleration? Assume one-dimensional flow prevails.

3. The plane rectangular gate can pivot about the support at \( B \). The rectangular gate is 1 m wide. Calculate the hydrostatic force acting on the gate. For the conditions given, is it stable or unstable? Neglect the weight of the gate.

![Figure 3 (for Problem 3)](image3)

![Figure 4 (for Problem 4)](image4)

4. The pipe flow in Figure 4 fills a cylindrical tank as shown. At time \( t = 0 \), the water depth in the tank is 30 cm. Estimate the time required to fill the remainder of the tank.